PATENT CLAIMS

1. A radio-frequency filter arrangement having at least one filter (F1, F2, F3), which has a number of cavities (21,..,24) which are coupled to one another for radio-frequency purposes and in each of which a dielectric resonator element (44) is arranged in a fixed position, and in each of which a dielectric body (45) is provided, whose position relative to the dielectric resonator element (44) can be varied in order to tune the frequency of the filter (F1, F2, F3), characterized in that the dielectric body (45) is arranged in an eccentric cutout (59) in the dielectric resonator element (44), and in that the dielectric body (45) is arranged in the eccentric cutout (59) such that it can rotate.

2. The radio-frequency filter arrangement as claimed in claim 1, characterized in that the dielectric resonator element (44) is in the form of a planar, round circular disk, and in that the dielectric body (45) can rotate about a rotation axis (60) which is at right angles to the disk plane of the dielectric resonator element (44).

3. The radio-frequency filter arrangement as claimed in claim 2, characterized in that the dielectric resonator element (44) has a predetermined thickness, and in that the dielectric body (45) has a height in the direction of the rotation axis which is essentially equal to the thickness of the dielectric resonator element (44).

4. The radio-frequency filter arrangement as claimed in claim 2 or 3, characterized in that the cutout (59) in the dielectric resonator element (44) is a circular cylindrical through-hole which is concentric with respect to the rotation axis (60).

5. The radio-frequency filter arrangement as claimed in claim 4, characterized in that the external dimensions of the dielectric body (45) are matched to the cutout (59) in the dielectric resonator element (44) in such a way that the two are separated from one another by only narrow air gaps.

6. The radio-frequency filter arrangement as claimed in claim 5, characterized in that the dielectric body (45) is bounded by two parallel planar surfaces (61, 62) in a first direction at right angles to the rotation axis (60), and is bounded by two cylindrical envelope surfaces (63, 64) which are concentric with respect to the rotation axis (60), in a second direction, which is at right angles to the rotation axis (60) and to the first direction.

7. The radio-frequency filter arrangement as claimed in one of claims 1 to 6, characterized in that the dielectric resonator element (44) has a central through-hole (58).

8. The radio-frequency filter arrangement as claimed in one of claims 1 to 7, characterized in that the dielectric resonator element (44) and the dielectric body (45) are each composed of the same material.

9. The radio-frequency filter arrangement as claimed in one of claims 1 to 8, characterized in that the at least one filter (F1, F2, F3) is accommodated in a preferably rectangular filter housing (10), in that the filter housing (10) is formed from a base plate (11) and wall plates (12, 14, 20, 32), which are at right angles to the base plate (11) for the side walls, and is covered on the top face by a motor mounting plate (13), which is parallel to the base plate (11), and in that the cavities (21,...,24) in the filter (F1, F2,

F3) are formed by separating plates (15,...,19; 33) which are incorporated in the filter housing (10) and are at right angles to the base plate (11).

10. The radio-frequency filter arrangement as claimed in claim 9, characterized in that mounting slots (34, 36,...,39) are provided in the base plate (11), in the wall plates (12, 14, 20, 32) and in the separating plates (15,...,19; 33), by means of which the plates are plugged into one another and are connected to one another, in particular by being soldered.

11. The radio-frequency filter arrangement as claimed in claim 9 or 10, characterized in that coupling openings, in particular coupling slots (35), are provided at predetermined points in individual separating plates (15,...,19; 33).

12. The radio-frequency filter arrangement as claimed in one of claims 9 to 11, characterized in that a preferably circular opening (25) is provided in the motor mounting plate (13) above each of the cavities (21,...,24), through which the respective dielectric resonator element (44) and the respective dielectric body (45) are held in the cavity.

13. The radio-frequency arrangement as claimed in claim 12, characterized in that the dielectric resonator element (44) and the dielectric body (45) are part of a tuning element (40) which is associated with the cavity and is mounted on the motor mounting plate (13).

14. The radio-frequency filter arrangement as claimed in claim 13, characterized in that the tuning element (40) in each case has a fixed holder (46), which passes through the opening (25) in the motor mounting plate (13), for the dielectric resonator element (44), a

holder (47) which passes through the opening (25) in the motor mounting plate (13) and is mounted such that it can rotate, for the dielectric body (45), a motor (41) and a gearbox unit (42), which transmits the rotational movement of the motor (41) to the holder (47), which is mounted such that it can rotate.

15. The radio-frequency filter arrangement as claimed in claim 14, characterized in that the motor (41) is a stepping motor.

16. The radio-frequency filter arrangement as claimed in one of claims 14 or 15, characterized in that the gearbox unit (42) is accommodated in a housing (43), in that the housing (43) is mounted on a motor mounting plate (13), in that the motor (41) is flange-connected to the housing (43), and in that the holder (46) for the dielectric resonator element (44) is attached to the housing (43).

17. The radio-frequency filter arrangement as claimed in claim 16, characterized in that the gearbox unit (42) has a rotating element (49) which is in the form of a shaft, is mounted in a prestressed precision bearing (48) and is firmly connected to the holder (47) for the dielectric body (45), and in that the rotating element (49) is driven by a drive shaft (55) within the gearbox unit (42) via a gearwheel (51) which is firmly seated on the rotating element (49), with the drive shaft (55) being connected to the motor (41) and engaging with the gearwheel via a worm gear.

18. The radio-frequency filter arrangement as claimed in claim 17, characterized in that the rotating element (49) is prestressed in the rotation direction in order to overcome play, preferably by means of a spiral spring (50).

19. The radio-frequency filter arrangement as claimed in one of claims 17 or 18, characterized in that the gearwheel (51) is designed in the form of a circle segment.

20. The radio-frequency filter arrangement as claimed in one of claims 1 to 19, characterized in that each of the filters (F1, F2, F3) has four cavities (21,...,24) with dielectric resonator elements (44) and dielectric bodies (45) which can rotate arranged in them.

21. The radio-frequency filter arrangement as claimed in claim 20, characterized in that the four cavities (21,..., 24) are arranged adjacent to one another in a square.

22. The radio-frequency filter arrangement as claimed in claim 20, characterized in that a number of filters (F1, F2, F3), each having four cavities (21,..,24) are arranged alongside one another in a common filter housing (10).

23. The radio-frequency filter arrangement as claimed in one of claims 1 to 22, characterized in that the cavities (21,..,24) are coupled by means of coupling slots (35) which are each arranged on a vertical center plane of the cavities to be coupled, and in that the eccentric cutouts (59) in the dielectric resonator elements (44) are arranged rotated through a predetermined angle, preferably about 57°, from the vertical center plane about the axis of the dielectric resonator element (44).

24. The radio-frequency filter arrangement as claimed in one of claims 1 to 23, characterized in that a controller (65), which has a control block (66), a memory (67) and an input unit (68), is provided in the eccentric cutouts (59) in the dielectric resonator

bodies (44) in order to control the rotation of the dielectric bodies (45).

25. The radio-frequency filter arrangement as claimed in claim 24, characterized in that position sensors, in particular in the form of light barriers (52, 53) which are connected to the control block, are provided in order to determine the initial position of the dielectric bodies (45) in the radio-frequency filter arrangement.

26. The radio-frequency filter arrangement as claimed in one of claims 24 and 25, characterized in that value tables are stored in the memory (67) and associate an appropriate angle position of the dielectric bodies (45) with a small number of selected frequencies of the radio-frequency filter arrangement.

27. A method for production of a radio-frequency filter arrangement as claimed in one of claims 1 to 26, characterized in that a number of planar sheet-metal parts (11, 12, 14,..,20, 32, 33) are connected to a filter housing (10) in order to form the cavities (21,..,24).

28. The method as claimed in claim 27, characterized in that the sheet-metal parts (11, 12, 14,..,20, 32, 33) are silver-plated, and are soldered to one another by means of a silver solder.

29. The method as claimed in claim 28, characterized in that the sheet-metal parts (11, 12, 14,..,20, 32, 33) have mounting aids, in particular in the form of crossing slots (34, 36,..,38), mounting slots (39) and mounting lugs (L1, L2) which are matched to one another, in that the sheet-metal parts (11, 12, 14,..,20, 32, 33) are initially loosely plugged together by means of the mounting aids and the crossing

slots (34, 36,..,38), mounting slots (39) and mounting lugs (L1, L2) in order to form the filter housing (10), and the plugged-together filter housing is made mechanically robust by pushing the mounting lugs (L1, L2) into the mounting slots (39), in that silver solder, preferably in paste form, is applied to the junction points between the plugged-together sheet-metal parts (11, 12, 14,..,20, 32, 33), and in that the plugged-together sheet-metal parts (11, 12, 14,..,20, 32, 33) are heated, preferably in an oven, until the silver solder melts and flows into the junction points.

30. The method as claimed in one of claims 27 to 29, characterized in that all of the sheet-metal parts (11, 12, 14,..,20, 32, 33) of a filter housing (10) are cut from a common metal sheet (69), which has not been silver-plated, by means of a cutting method, preferably by means of laser cutting, in such a way that the cut-out sheet-metal parts (11, 12, 14,..,20, 32, 33) are connected to the remaining area of the metal sheet (69) only by a small number of narrow webs, in that the metal sheet (69) together with the cut-out sheet-metal parts (11, 12, 14,..,20, 32, 33) is then silver-plated, in that the sheet-metal parts (11, 12, 14,..,20, 32, 33) are detached from the metal sheet (69) after being silver-plated, and are then used to construct the filter housing (10).

31. The method as claimed in claim 30, characterized in that the webs remain predominantly at those points on the sheet-metal parts (11, 12, 14,..,20, 32, 33) which are located outside the cavities (21,..,24) when the filter housing (10) is complete.